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I, JONNE YABSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2002953249 for a patent by TRANSURBAN INFRASTRUCTURE DEVELOPMENTS LIMITED as filed on 10 December 2002.



WITNESS my hand this  
Twenty-second day of December 2003

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**Transurban Infrastructure Developments Limited**

**A U S T R A L I A**

**Patents Act 1990**

**PROVISIONAL SPECIFICATION**

for the invention entitled:

**"Over-height vehicle barriers"**

The invention is described in the following statement:

## OVER-HEIGHT VEHICLE BARRIERS

The present invention relates to over-height vehicle barriers for installation in advance of a road tunnel, a bridge or other structure where vehicle height limitations apply.

5 It is common practice to install on a roadway in advance of a tunnel, a bridge, or other structure where a height limitation applies, a over-height barrier which will be contacted by an over-height vehicle before the vehicle actually reaches the height-restricted zone of the tunnel, bridge or other structure.

One prior form of over-height vehicle barrier consists of a heavy beam rigidly  
10 mounted, the objective of the beam being to physically stop the over-height vehicle before it comes into contact with the structure being protected. This is not particularly satisfactory as engagement with the beam can result in part of an over-height load being dislodged into the path of other vehicles and also engagement with the beam may cause the vehicle to stop very suddenly, also presenting a danger to following vehicles and vehicles  
15 in adjacent lanes. When the beam is struck, its supporting structure will be subject to substantial impact loading; as, sometimes, such beams are mounted directly to a bridge or tunnel entrance, some damage may still result to the structure intended to be protected.

A variation of the fixed rigid beam over-height barrier is a sliding beam barrier consisting of a heavy beam mounted on rails which enable the beam to be pushed in the  
20 direction of traffic flow by an over-height vehicle. The vertical clearance between the rails and the road increases so that as the beam is pushed further along the rails the extent of interference is diminished. However if the vehicle is higher than the beam clearance at the far end of its travel, the results will be similar to those experienced using the fixed rigid beam as discussed above. In addition, due to the weight of the beam it is still possible for  
25 the beam to dislodge part of the vehicle's load into the path of other vehicles.

Another prior form of over-height barrier comprises a heavy beam or weights suspended by chains or cables from a supporting structure. This is also unsatisfactory in some situations, as there is a risk that part of the load might become entangled within the chains or cables if the load is excessively high as may arise with a carrier for earth-  
30 working machinery having a long boom arm which can extend to a substantial height even when parked for transportation. This may result in parts of the barrier including its

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supporting structure being damaged or dislodged. Also, again, due to the weight of the barrier, part of the over-height load of the vehicle may become dislodged into the path of other vehicles.

According to the present invention there is provided an over-height vehicle barrier,  
5 said barrier comprising a series of over-height vehicle engaging members mounted in closely-spaced relationship on a supporting beam mounted above a carriageway such that each member hangs beneath the beam for possible engagement by an over-height vehicle, each member being pivotally mounted to the beam at an upper end portion thereof such that each member can pivot about the axis of the beam independently of the other members  
10 when struck by an over-height vehicle, and a further beam spaced from the supporting beam to be engaged by said members pivoting about the supporting beam when struck by an over-height vehicle and to thereby cause the members to pivot in a return direction, engagement of said members by a vehicle generating a warning noise to alert the driver of the vehicle.

15 In a preferred embodiment of the invention each of the engaging members is in the form of a blade with substantially flat parallel sides, the blade preferably being of downwardly tapering profile when viewed from the side.

Advantageously the supporting beam is of circular cross section to provide a direct pivotal mounting for each blade.

20 The blades are each of a semi-rigid structure capable of deforming upon impact to absorb energy. In one preferred form, the blades are composed of polyurethane.

The further beam against which the blades impact is preferably a gantry beam from which the supporting beam is rigidly mounted so that the supporting beam lies beneath the gantry beam. The gantry beam is preferably a tube of circular section so that when  
25 impacted by the pivoting blades the gantry beam will generate a loud resonant noise.

An embodiment of the invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 shows schematically an over-height vehicle barrier installed above a carriageway;

30 Figure 2 is a front view to an enlarged scale showing part of the structure of the barrier including supporting beam, pivotal or swinging blades mounted from the

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supporting beam, and a gantry beam which carries the supporting beam;

Figure 3 is a side view showing the gantry beam and hanger plates by which the supporting beam is mounted from the gantry beam; and

Figure 4 is a side view to a further enlarged scale showing one of the blades.

5       The over-height vehicle barrier in accordance with the preferred embodiment of the invention comprises a series of separate blades 2 mounted in closely-spaced relationship along the length of a supporting beam 4 (see Figure 2) in such a manner as to enable the blades 2 individually to freely pivot or swing about the axis of the supporting beam 4. For this purpose, in the preferred embodiment, the supporting beam 4 consists of a rigid metal  
10   tube of circular cross section on which each blade 2 is rotatably mounted by a suitable bearing arrangement 6 within the upper end portion of the blade 2 and through which the tube extends. The supporting beam 4 itself is carried from a gantry beam 8 by hanger plates or struts 10 welded to the gantry beam 8 and extending downwardly from the gantry beam 8 so that supporting beam 4 is located beneath the gantry beam 8 and is vertically  
15   spaced therefrom. The depth of the supporting beam 4 beneath the gantry beam 8 is such that the presence of the gantry beam 8 inhibits complete rotation of the blades 2 about the supporting beam 4 for reasons to be described subsequently. The gantry beam 8 is itself preferably also a tubular beam of circular cross section.

20   In the particular configuration shown in Figure 1, only some of the lanes of the carriageway require over-height protection and the beam 4 with blades 2 is only positioned above those lanes, whereas the gantry beam 8 spans the entire carriageway and is supported at each end by posts 12. Other supporting structure for the gantry beam 8 can alternatively be provided and it will be understood that the actual configuration of the  
25   beam 4 with blades 2 in relation to the carriageway will be determined by the over-height protection to be provided on a site-by-site basis.

Each of the blades 2 is of a constant width when viewed from the front of the barrier (see Figures 1 and 2) with flat parallel sides and tapers towards its lower end when viewed from the side as shown in Figure 4. Preferably the blades are formed of a semi-  
30   rigid plastics material such as polyurethane with a structure which enables the blade to deform and absorb energy when struck by an over-height part of a vehicle travelling

through the barrier.

Each blade 2 has a substantial length, for example between 1.3 and 1.5 metres so as to provide a substantial projection beneath the supporting beam 4. Accordingly, the beam 4 can be mounted at such a height above the carriageway that the likelihood of that beam being struck even by a load which is excessively over-height is extremely small.

As discussed above, each blade 2 is of substantially constant width when viewed from the front of the barrier and the blades 2 are mounted in closely spaced relationship along the length of the beam 4, being separated for example by washers 14. Accordingly, when viewed by the driver of an approaching vehicle, the array of closely spaced blades 2 itself gives the appearance of a solid beam and this sense can be increased by differently colouring adjacent groups of blades in contrasting colours, typically black and yellow, to give the impression of vertical warning stripes along the length of the seemingly solid beam as shown in Figure 1.

In the event that the barrier is struck by an over-height vehicle, which could be travelling at speeds up to 80 km/hr, those blades 2 engaged by the over-height part of the vehicle will be struck with a high impact force and will swing upwardly around the supporting beam 4 at relatively high velocity to engage the rear side of the gantry beam 8. Upon engagement with the gantry beam 8, the blades 2 will be deflected downwardly in the reverse direction. The actions which have just been described will typically take place within a fraction of a second. If the over-height part is of sufficient length the blades may be re-engaged and swung against the gantry beam 8 one or more further times. The initial impact of the vehicle with the blades 2 will generate noise as will any subsequent impact following deflection by the gantry beam 8. The gantry beam 8 itself, being hollow, will also generate substantial noise when struck by the swinging blades 2. Accordingly, engagement of the vehicle with the blades 2 will create a significant impact noise which should suggest to the driver that significant impact damage may have arisen thereby inducing the driver to stop. However, due to the semi-rigid nature of the structure of the blades 2 and the mounting of the blades 2 on the supporting beam 4 for free pivotal movement, engagement of the blades 2 by the vehicle will be unlikely to dislodge part of its load into the path of other vehicles even if the over-height part causes several return impacts on the blades 2. Moreover the barrier, although providing a very loud and distinct

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5 warning which should induce the driver to stop, will not actually stop the vehicle itself with consequential risk of collision with other vehicles. When the vehicle has stopped beyond the barrier, it is then able to be reversed back through the barrier, with the blades 2 then being pivoted upon engagement with the over-height part in the reverse direction to permit passage of the vehicle. Under these conditions the vehicle will be travelling quite slowly and engagement of the blades with the over-height part will simply allow the blades to lift and allow passage of the vehicle.

The barrier described also permits the passage of authorised over-height vehicles to pass through the barrier under permitted and controlled conditions.

10 The blades must be of robust construction to withstand repeated impact with vehicles while being capable of deflection to absorb energy upon impact. The blades should also be of relatively light weight to reduce centrifugal and inertial forces on impact to prevent dislodging of part of the load and also to prevent damage to the supporting structure. Blades constructed principally from polyurethane are suitable for this purpose.

15 The bearing arrangement 6 and associated structure incorporated into the upper part of the blade 2 as an integral part during manufacture is such as to permit the blades 2 individually to be removed and replaced on the supporting beam 4 with the beam 4 remaining *in situ*.

The embodiment has been described by way of example and modifications are possible within the scope of the invention.

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DATED this 10<sup>th</sup> day of December 2002

**Transurban Infrastructure Developments Limited**

25 by their Patent Attorneys  
DAVIES COLLISON CAVE

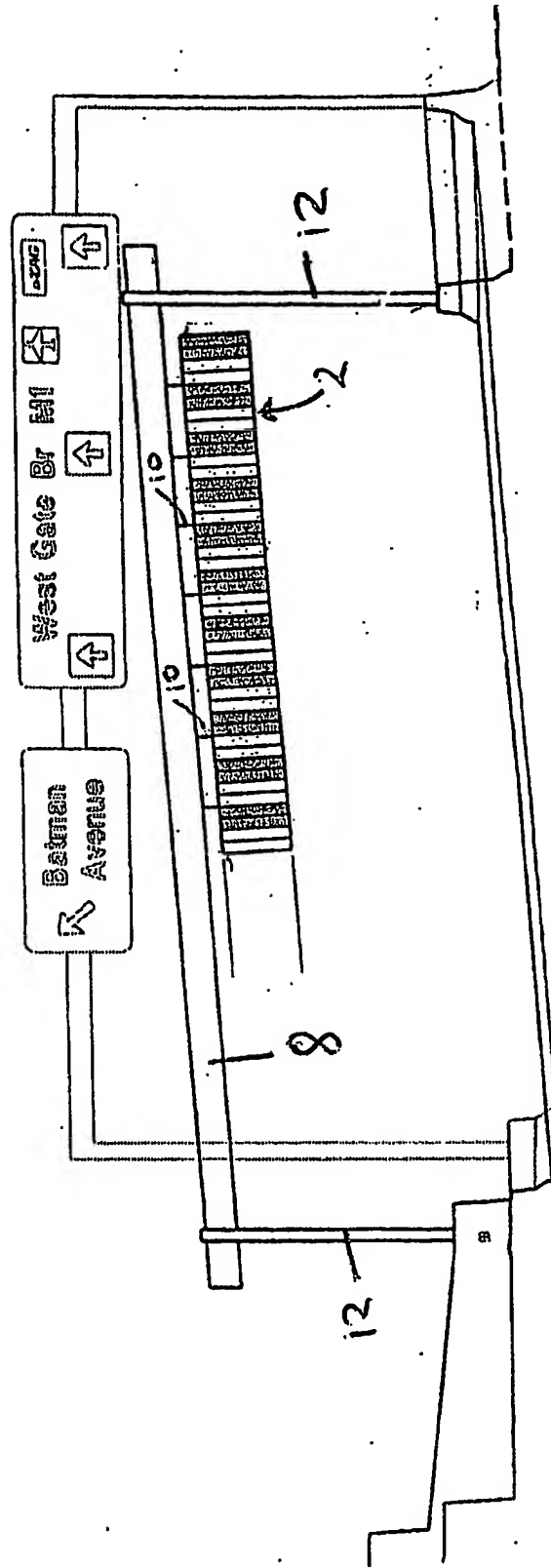


FIG. 1



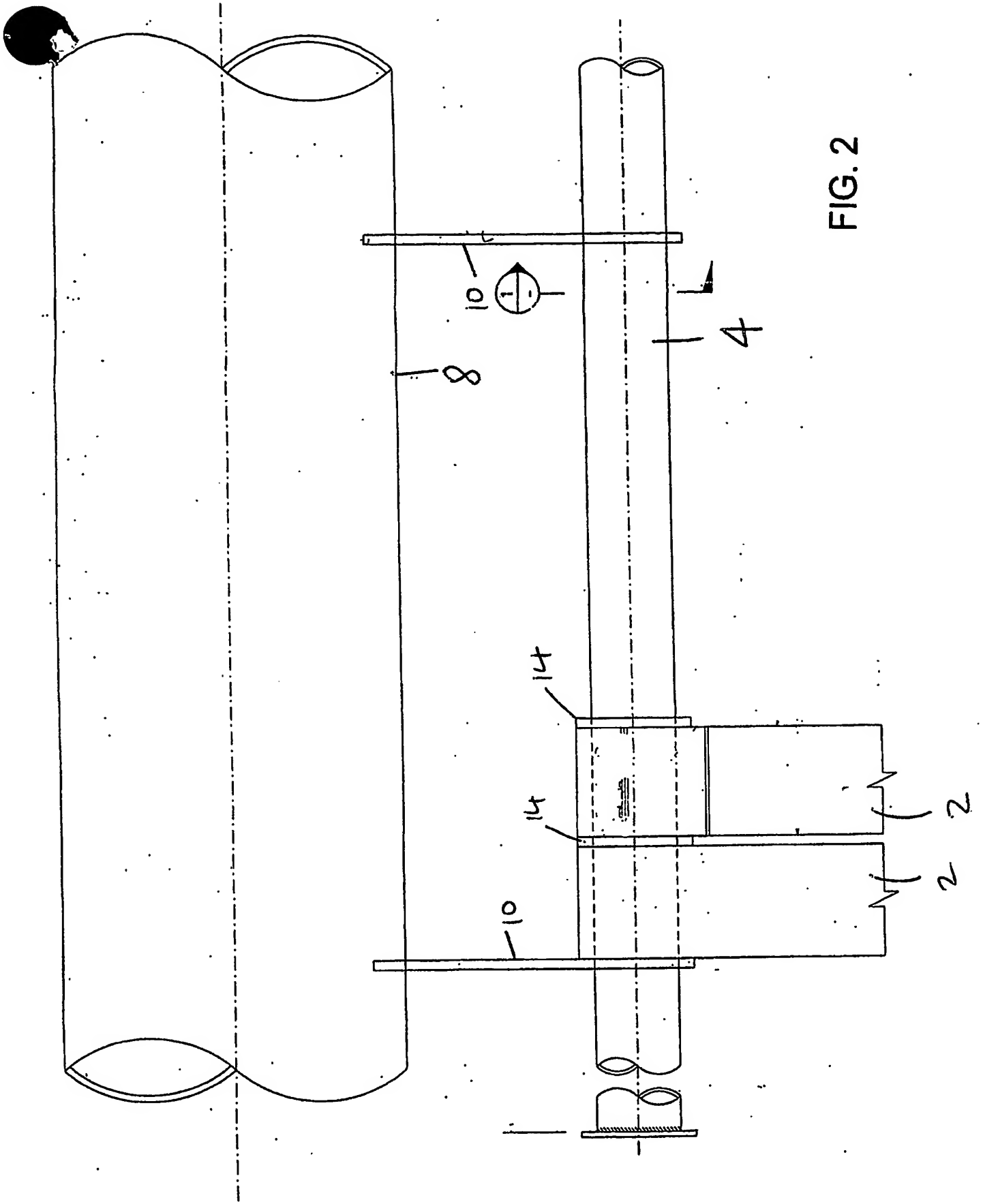


FIG. 2

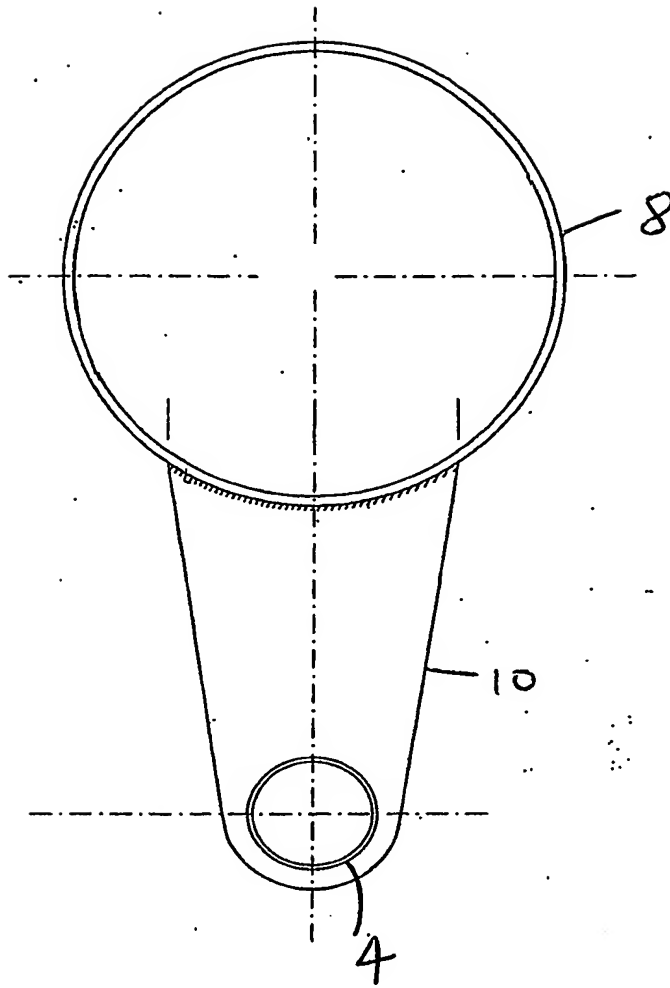


FIG. 3

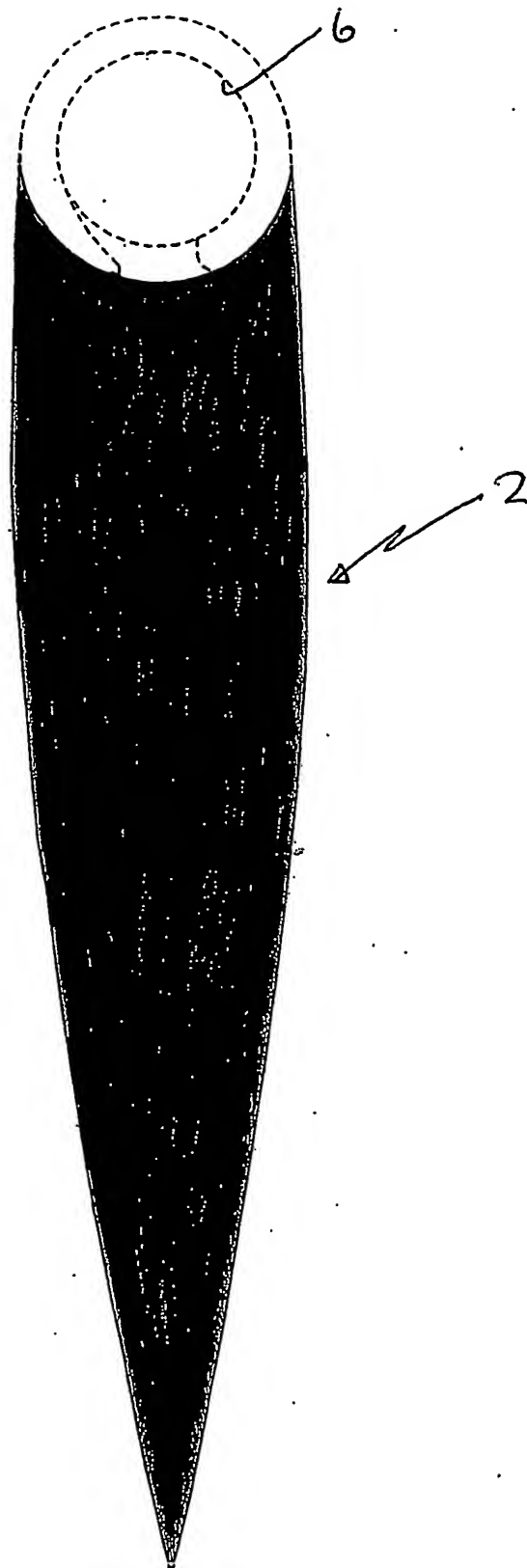


FIG. 4